9. Some Notes on *Leander longirostris* M. Edwards, and other British Prawns. By Robert Gurney, M.A., F.L.S., F.Z.S.

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(Text-figures 1–6.)

Contents.

The European Prawns of the genus *Leander* have been very thoroughly revised by De Man *, who has shown that *L. longirostris* occurs commonly on the Dutch coasts, where it has hitherto been recorded under the name of *L. squilla*. The two species closely resemble one another in respect of the form of the rostrum, but differ greatly in other respects, and De Man's very careful and detailed description has made discrimination of the species an easy matter.

In Norfolk a prawn has long been known to occur in the lower reaches of the rivers flowing into Breydon Water, and has been recorded by Mr. A. H. Patterson † and myself ‡ under the name of *L. squilla*. Having obtained a number of specimens of this prawn from Breydon Water in June 1921, a careful examination of these specimens was made, with the result that it became perfectly clear that they could not be referred to any species hitherto recorded as British. Subsequent reference to De Man's paper at once proved them to belong to *Leander longirostris* M. Edw. An examination of old material and of specimens since collected in the Norfolk rivers and at various points on the coast has shown that *L. squilla* does not normally occur at all in any part of the rivers, but that it is quite common between tide-marks on the coast.

I have also visited the estuaries of the East Coast from Norfolk to the Thames, and have not been able to obtain any evidence of the occurrence of *L. longirostris* anywhere except in Breydon Water and the rivers entering it.

* De Man, Tijdschr. Nederl. Dierk. Vereen. (2) xiv. p. 115 (1915–16).
† Zoologist, (4) ii. p. 178 (1898).
‡ Trans. Norf. & Nor. Nat. Soc. vii. p. 637 (1904).

It may be of interest not only to give some account of the distribution and habits of *L. longirostris* in Norfolk, but also to add some notes on the remaining four species of British Prawns.

The structural specific differences have been dealt with so thoroughly by De Man that it is not necessary to repeat them in great detail, but I have added some account of the colour of living specimens, since the species may readily be distinguished when alive by colour alone, and this is a character to which sufficient importance has not been attached. Some account is also given of the range of variation of certain characters which are regarded as of specific importance.

In the following table, measurements are given of typical examples of the five British species. For purposes of comparison the absolute measurements of the antennule and second leg have been converted into percentages of the peduncle and dactylus respectively. There is much individual variation, and the proportions of these parts are very different in immature specimens, so that such selected examples can only be taken as a general guide; but they illustrate very well the characters of the differences generally to be observed.

TABLE I.

Measurements of typical individuals of the British species of Prawn. The measurements for 2nd leg and antennule are converted to percentages of the dactylus and peduncle respectively.

	Locality.	Total length.	Rostrum.	2ND LEG.					1ST ANTENNA.			
				Dactylus.	Chela.	Palm.	Carpus.	Merus.	Peduncle.	Shorter outer flagellum.	Basal part.	Accessory part.
L. serratus ♂ ...	Burnham.	86 mm.	7/4	100	191	91	100	133	100	83	16	66
L. squilla ♀ ...	Thornham.	57 „	8/3	100	303	203	290	258	100	106	47	57
L. adspersus ...	Poole.	68 „	6/3	100	229	129	195	183	100	122	39	83
L. longirostris...	Breydon.	69 „	8/4	100	266	166	246	233	100	65	17	48
P. varians	Cley.	43 „	5/2	100	300	200	410	235	100	80	58	21
„	„	38 „	6/2	100	253	153	286	244	100	107	77	30

Key for determination of the Species.

1.	Carpus of 2nd leg much shorter than merus	*L. serratus.*
	Carpus longer than merus	2.
2.	Carpus of 2nd leg longer than chela	*Palæmonetes varians.*
	Carpus shorter than chela	3.
3.	Dactylus of 2nd leg one-third the length of the chela	*L. squilla.*
	Dactylus nearly or quite one-half length of chela	4.
4.	Short flagellum of antennule as long as or longer than peduncle	*L. adspersus.*
	This flagellum much shorter than peduncle	*L. longirostris.*

1. Leander serratus (Pennant).

Colour.—Thorax and abdomen strikingly banded with brownish red, the lines on the thorax running almost horizontally, or obliquely forwards and upwards. Rostrum covered with small red chromatophores. Legs banded with purple and yellow.

Rostrum slender and greatly exceeding the length of the antennal scales. It is conspicuously upturned and devoid of spines in its distal third. The apex is bifid, and the usual number of spines is 7 dorsally and 5 on the ventral margin. The first spine is situated well behind the eye, and the second either above or slightly behind it.

De Man (*ibid.* p. 169) has described three specimens in which the rostrum was of abnormal form, and I have had the opportunity of examining two specimens in the museum of the Marine Laboratory at Plymouth which are of some interest. In both these cases (measuring 57 and 54 mm.) the rostrum is straight, without the upturned toothless portion characteristic of *L. serratus*, the apex undivided. The spine-formula is $\frac{6}{2}$ and $\frac{7}{2}$.

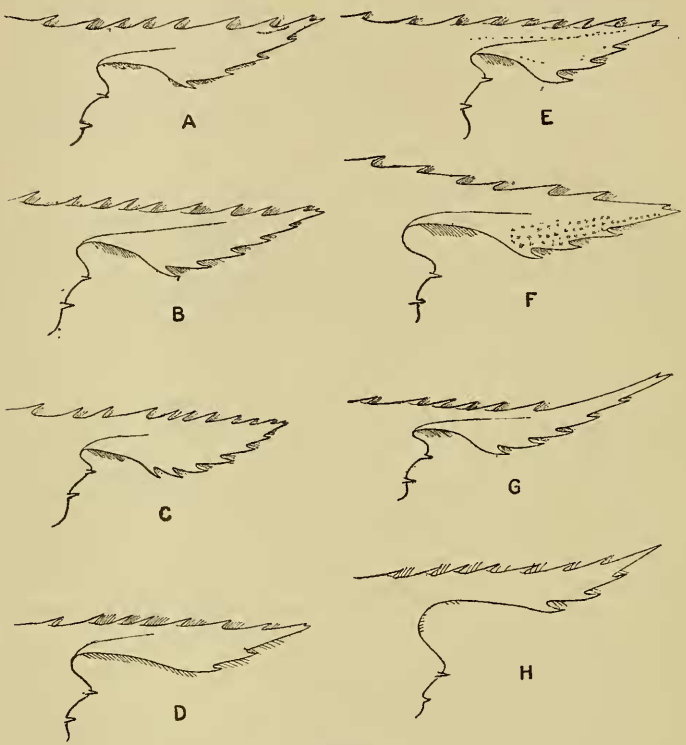
In both cases the general resemblance of the rostrum to that of *L. squilla* was rather striking, and they also agreed more with *L. squilla* in having the short flagellum of the antennule approximately equal in length to the peduncle. On the other hand, the form of the second leg, and in one case the palp of the mandible (that of the other was not seen), left no doubt that these were two abnormal examples of *L. serratus*.

In quite young specimens up to about 25 mm. the rostrum alone is by no means a safe guide to identity. In the autumn on the South Coast young *L. squilla* and *L. serratus* are found commonly in rock-pools mingled together, and their separation is not altogether easy. In such specimens the length of the dactylus of the second leg is also an unreliable character, since this joint in specimens of *L. squilla* up to 15 mm. may nearly equal the length of the palm, and the adult form is only gradually assumed. On the other hand, the antennule provides, as I believe, a safe means of separating the two species. In such small specimens of *L. squilla* the free part of the shorter ramus is much shorter than

the fused* part, whereas in *L. serratus* it is considerably longer.

Antennule.—The short flagellum is about one-seventh shorter than the peduncle, and the fused part one-quarter or one-fifth of its total length.

Text-figure 1.



Rostrum.

A. *Leander longirostris.* B, C. *L. longirostris* with unusual number of teeth. D. *Palæmonetes varians.* E. *L. squilla.* F. *L. adspersus.* G. *L. serratus* (adult). H. *L. serratus* (young, 15 mm. long).

Second Leg.—Dactylus nearly half the length of the chela; carpus shorter than the chela or the merus.

Distribution.—This, the so-called "Common" Prawn, is a littoral species, preferring, but not confined to, weedy and rocky ground. It is abundant on the south coast of England and on

* The inner, shorter, branch of tho outer flagellum is usually described as being fused to the outer branch for part of its length, and the terms "fused" and "free" part are convenient and intelligible. But the "free" part is clearly shown in development to be a secondary or accessory outgrowth of the basal, sensory, part of the flagellum. The basal part, plus the accessory flagellum, is here spoken of as the "shorter flagellum" simply for convenience of description.

some parts of the Irish coast, but it is by no means common on the East Coast north of the Thames. Murie* has given an excellent account of the distribution of this prawn, to which I can add little. The shrimpers from Southend and from Burnham-on-Crouch bring in fair numbers of them, but at West Mersea they are much more rare. I have been to sea with one of these shrimpers and saw only one prawn in a catch of 12 gallons of "Pink Shrimps" (*Pandalus montagui*). At Harwich also the prawns brought in are so few as to be hardly worth the trouble of separating them from the shrimps. They are said to be taken at times in some numbers in the Orwell and Deben, and I have myself taken them as far up the Deben as Woodbridge. At Aldeburgh the species is so rare that a fisherman who took one among his shrimps in 1921 had never seen one before! Off Yarmouth the capture of prawns is exceptional, though a few are sometimes taken on the sandy ground close inshore, and I have myself seen specimens taken on Breydon Water. At Lynn it appears to be almost unknown.

L. serratus has been recorded from Oresund (Denmark), and is found on the coasts of Holland, Belgium, France, and the Channel Islands. In the Mediterranean it occurs in "prodigious quantities" on the coast of Algeria (Lucas), and inhabits the shores of Italy, Greece, and the Bosphorus.

It is therefore a southern species, which is only a straggler in the North Sea.

Breeding-period.

Whereas the other species of British prawns breed during a well-defined period in summer, the breeding-period of *L. serratus* seems to extend through winter and to continue till midsummer. In the List of the Plymouth Marine Invertebrate Fauna† it is recorded as breeding from November to June, but egg-bearing females may still be found in July. I have little personal acquaintance with this species, since it is so rare off the Norfolk coast, but it seems to me that the few published records indicate that *L. serratus* may prove to have a breeding-habit somewhat similar to that of *Crangon vulgaris*. In this species Ehrenbaum‡ found two main periods of egg-laying—namely, April–June and October–November. The autumn-laid eggs took 4 to 5 months to develop, and hatched from February to April, while those laid in summer hatched in about 4 weeks—*i. e.*, from May to August.

Larvæ of *L. serratus* are found in very small numbers in the plankton from December onwards.

Owing to the difference in the breeding period, any *Leander* larvæ found off British coasts from December to nearly the end of June may confidently be assigned to *L. serratus*.

* Report on the Sea Fisheries and Fishing Industries of the Thames Estuary, p. 247. London, 1903.

† Journ. M. B. A. vii. (1904).

‡ Mitth. der Sekt. für Kusten und Hochseefischerei, Jg. 1890.

2. Leander squilla (Linn.).

Colour.—Both thorax and abdominal segments bear dark yellow-brown bands, which are usually very conspicuous, and are retained for a long time even in specimens preserved in formol, though rapidly disappearing in spirit. The rostrum is sometimes quite colourless, but generally small red chromatophores are scattered over it or arranged in a median row. Kemp states that the rostrum is without chromatophores, but this is exceptional in my experience of Norfolk specimens. The eye-stalks and peduncles of the antennules are deeply pigmented with purple-brown, and the same is the case with the basipodite and ischium of the third, and sometimes of other, legs. The joints of the legs are marked by bands of yellow pigment, and the palm of the chela of the second legs is bright blue. The intensity of the colour seems to vary to some extent with locality and season. In the summer of 1921 all the prawns, of all ages, taken in Wells Harbour, were brilliantly coloured as described above, the blue of the chelæ being particularly conspicuous. But others taken from rock-pools at Whitsand Bay in the spring of 1922, though showing the same distribution of colour, were by no means conspicuously banded. They could, however, be immediately distinguished from *L. serratus* of the same size by their darker colour. Again, the colouring of the prawns in Wells Harbour during the summer of 1922 was far from being so pronounced as in the previous year, and many, particularly the males, were found to be almost colourless. The blue colour which was so striking a feature of the chelæ in 1921 was seldom brilliant, and often absent, in 1922.

Length. Male 28–50 mm. Female 30–63 mm.

The great range in size is due to the fact that maturity is reached in the first year at an average size of about 40 mm. for females and 30 mm. for males. Females over 50 mm. may be assumed to be two years old, and it is probable that those of 60 mm. and more are in their third year.

Rostrum broad, very slightly upcurved, armed dorsally with 7–9 teeth, two of which are placed behind the eye, and the third above or slightly behind it. A minute apical tooth is almost invariably present in addition. Ventral teeth usually three. The number of these teeth varies within very narrow limits. For 114 females from Wells, in Norfolk, the number of teeth was as follows:—

Dorsal teeth:	9	8	7	6
No. of individuals:	12	65	36	1
	10·5 %	57 %	31·5 %	·86 %

Ventral teeth:	4	3	2
No. of individuals:	1	112	1
	·86 %	98·2 %	·86 %

Adding 62 specimens from various localities on the East Coast south of Norfolk the frequency is somewhat changed :—

Dorsal teeth :	9	8	7	6
Individuals :	22	101	52	1
	12·5 %	57·4 %	29·5 %	·57 %

There seems to be a somewhat higher frequency for 9 dorsal teeth than there is in Norfolk, but the number examined is not sufficient for a definite conclusion. De Man's figures for 106 specimens from various localities are as follows :—

Dorsal teeth :	9	8	7
Individuals :	20 %	66 %	13 %

In the typical form of *L. squilla* from Scandinavia, De Man found seven dorsal teeth in 31 per cent. of specimens and nine teeth in 18 per cent.

Such figures as these seem to indicate a definite local variation in respect of this character, but in my opinion the material examined is only sufficient to indicate a probability that such variation occurs.

Mandible palp.—*L. squilla* differs from all other European species of *Leander* in having the mandible palp two-jointed. This difference was first pointed out by Dr. W. T. Calman *, but the palp was correctly figured by Ortmann in 1901 †, though not alluded to in his definition of the genus *Leander*. This character cannot be used in the determination of young specimens 20 mm. or less, since, in *L. longirostris* at all events, the mandible palp is still often two-jointed at that size.

Antennule.—The short flagellum is approximately equal in length to the peduncle, but may be either shorter or longer than it. This flagellum exceeds the length of the peduncle more frequently in the male than in the female. The free part generally exceeds the fused part in the proportion of 5 to 4.

Second Leg.—The second leg reaches, when extended, beyond the antennal scale by the whole chela or even by part of the carpus as well. The dactylus is conspicuously shorter than in the other species, being usually about one-third the length of the whole chela. The carpus nearly always slightly exceeds the length of the merus.

De Man, as the result of the examination of large numbers of

* See Kemp, "The Decapoda Natantia of the coasts of Ireland." Fisheries, Ireland, Sci. Invest. i. 1908, p. 127 (1910).

† "Die Klassen und Ordnungen der Arthropoden." Abth. Crustacea Malacostraca, Taf. lxxiv. fig. 2 *e* (1901).

L. squilla from many localities, has come to the conclusion that three varieties or geographical races should be separated :—

(1) *L. squilla*, typical form.
Scandinavia and the Baltic Sea.

(2) *L. squilla* var. *intermedia* De Man.
Holland, British, and probably French coasts.

(3) *L. squilla* var. *elegans* Rathke.
Mediterranean, Black Sea, Azores, Madeira, Canaries, Cape Verde Islands.

These varieties are separated by very slight differences, the most important and constant of which relate to the antennule—thus :—

(1) Fused part of short flagellum a little shorter or a little longer than the free part, rarely equal to it.
Typical form.

(2) Fused part distinctly shorter than free part.
var. *intermedia*.

(3) Fused part distinctly longer than free part.
var. *elegans*.

Norfolk specimens agree with the description of the variety *intermedia*, but it is possible, as De Man suggests, that *L. squilla* from Scotland may prove to belong to the typical northern race. I have not had the opportunity of examining specimens from the east coast of Scotland, but a male received from Millport on the west undoubtedly belonged to the var. *intermedia*, since the free part of the flagellum exceeded the fused part in the proportion of 5 : 4.

Distribution in Britain.—L. squilla appears to be distributed all round the coasts of England, Ireland, and Scotland, even as far as the Shetlands. It is a littoral species living between tide-marks, and I have found it to be abundant all along the Norfolk coast from Hunstanton to Cley. At Wells it can be caught in quantities by working a hand-net along the wooden quay-heading at high tide. The pools on the salt marshes at Wells are tenanted for the most part by *Palæmonetes varians*, but some were found in August to contain *L. squilla* in addition. At Thornham numbers were taken on the woodwork of a sluice, and I have found that such sluices, where a pool of water remains even at low tide, are favourite resorts for this species. In such situations it is quite commonly associated with *P. varians*, and it runs far up the East Coast estuaries, but it appears to be none the less intolerant of fresh water, and to abandon a sluice when a large quantity of fresh water is being discharged. It does not normally occur on Breydon or in any part of the rivers Yare, Bure, or Waveney. A single small specimen was, however, taken in

1921 by Mr. O. Hunt at Acle at a time of exceptionally high tides. I have taken it myself at the following places:—

R. Crouch at Burnham and Battlebridge.
Blackwater at Maldon.
Mersea Island.
R. Stour at Harwich and Wrabness.
R. Deben at Woodbridge.

I was unable to find it in the Alde between Aldeburgh and Iken, or in the Orwell at Pinmill.

Breeding-period.

In Norfolk the first eggs are laid about the end of May or beginning of June. One female, taken on June 1 with eggs apparently very recently laid, hatched her young on July 5, the eggs having therefore been borne 35–40 days. This result is in general agreement with Mr. Elmhirst's figures*. Mr. Elmhirst kept observation on *L. squilla* in rock-pools at Millport, and found the period of development to depend on temperature as follows:—

	Period of development.	Average temperature.
1921	30 days	23° C.
1911	40 days	14·5° C.
1912	56 days	11° C.

Development may therefore be taken as requiring about 6 weeks under usual conditions.

Breeding continues actively through June and July. In 1921 it ceased about the middle of August, but in 1922 it was continued into the first week of September—a period of about 100 days. Each breeding female seems to produce two broods in the season. In July females with eggs in an advanced stage of development always have the ovary distended with eggs of the second brood, while in August the ovary is usually empty. The production of two broods in the year was established by Mortensen† for *L. adspersus* and by Ehrenbaum for *Crangon vulgaris*, but Mortensen found that it only applied to the larger prawns. In Norfolk, on the other hand, not only does practically every female breed down to a size of about 30 mm., but the majority, at all events, produce second broods. In July the population of females may be separated into two groups—namely, a small number of large prawns from 63 mm. to about 48 mm., and the remainder of smaller prawns among which sizes of 36–39 mm. are the most frequent. These two groups no doubt comprise prawns of two years' and one year's growth. The former on July 25 for the most part bore eggs in early stages having hatched their first brood, while a large proportion of the

* Scottish Mar. Biol. Assoc. Ann. Rep. 1921, p. 7.
† Vid. Undersog. paa Fiskeriernes omraade udgivne af Dansk Fiskeriforening, i. (1897).

one-year group carried eggs approaching hatching or showed signs of having recently hatched young. It is probable, therefore, that the older prawns spawn before the younger ones.

The period of larval development has been ascertained by Mortensen to be about 4 weeks in *L. adspersus*, and is probably much the same for *L. squilla*. I have not been able to keep the larvæ through more than one moult, so have no direct evidence to offer. No post-larval prawns are to be found at Wells in July, but about the middle of August they begin to appear, and become abundant both in the marsh-pools and in the fucus growing on the woodwork of the quay. In 1922, young did not become abundant till the middle of September, but some then measured 22 mm. and must have been in the harbour for some time. For the most part the smallest young taken measure about 12 mm. Since the young in the first and second post-larval stages do not exceed 9 mm., it seems that metamorphosis occurs out at sea, and that the young do not usually reach the shore till after three or four moults. A very small proportion of the young prawns found in September 1922 were either in the first or second post-larval stages, and these must certainly have been brought in by the flood-tide and have metamorphosed on the spot. On the other hand, in spite of much search, I have only taken one larva in Wells Harbour, and there can be no doubt that the whole larval life is normally spent out at sea. This is in agreement with Mortensen's conclusions with regard to *L. adspersus*.

The proportion of adult males to females was only noted accurately on two occasions — in Wells Harbour on July 25, 1922, and in Blakeney Harbour on August 10. In the former case 37 males were found among 114 females, while in the latter the males exceeded the females, the numbers being 69 males and 56 females.

3. Leander adspersus Rathke.

Palæmon rectirostris Zaddach, 1844.
Palæmon leachii Bell, 1853, p. 307.
Leander adspersus var. *fabricii* De Man, 1916.

Colour.— Unlike the other British species of *Leander*, *L. adspersus* has no bands of colour on either thorax or abdomen, but the body appears of a uniform yellowish grey, due to small black or reddish-black chromatophores scattered irregularly. The rostrum is covered with chromatophores, which are concentrated on the lower half in the form of red or sometimes purplish-red blotches, which, as Kemp has pointed out, provides a conspicuous feature by which the species may be recognized at a glance. The long flagella and the peduncle of the antennule are also very red and the legs banded with yellow, but without the blue on the chela, which is so striking in *L. squilla*.

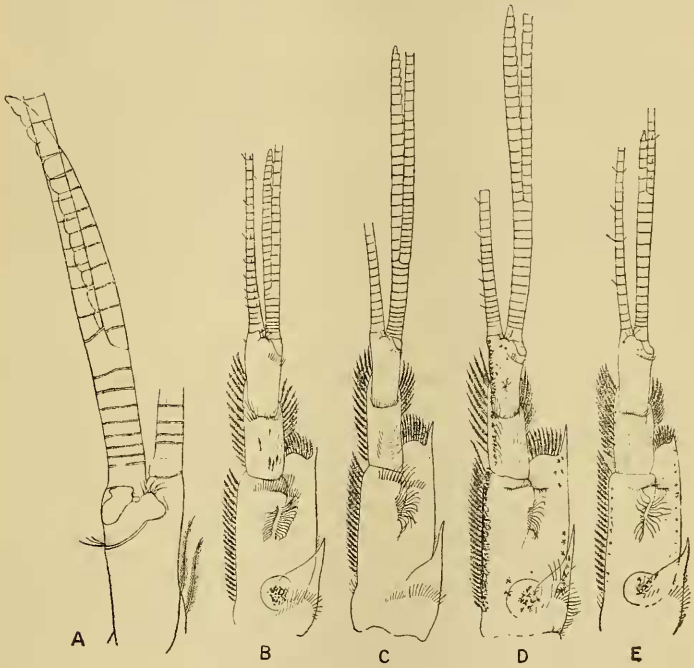
Rostrum.—The rostrum usually extends well beyond the antennal scales, is nearly straight, not very deep, and provided as a rule with 6 spines above and 3 below in addition to the small terminal spine. Only one of the dorsal spines is situated behind

the eye, the second usually slightly in front of the orbital notch. The dorsal teeth differ slightly from those of *L. longirostris* and *L. squilla* in being more depressed.

Mandible palp.—Three-jointed, the second joint about one-third the length of the last joint.

Antennule.—The shorter ramus exceeds the length of the peduncle, and is "fused" to the longer flagellum by only about one-third of its length. The length of the free part is a very noticeable character of the species. There are certain minor

Text-figure 2.



Antennule of female.

A. *L. longirostris,* drawn from moulted skin.
B. *L. longirostris.* C. *L. adspersus.* D. *L. squilla.* E. *P. varians.*

differences in the structure of the peduncle between the species of *Leander* and *Palæmonetes.* These relate to the proportional length of the joints and the form of the stylocerite and terminal plate, but they are less easily described than illustrated. In text-fig. 2 the antennules of the different species are drawn side by side to such scales that the peduncle is represented as of the same length in each case. The proportions of the joints and of the flagella are in this way made clear.

Second leg. — Extends beyond the antennal scales by the

dactylus and part of the palm. The dactylus is long and slender, more than three-quarters of the length of the palm. The carpus usually considerably exceeds the length of the merus, but may be of the same length.

De Man has separated this species into two forms:—

L. adspersus (Rathke). Black Sea.

L. adspersus var. *fabricii* (Rathke). Scandinavia, Baltic, Denmark, France, Adriatic, Mediterranean, British Isles.

The chief differences are as follows:—

Rostrum usually with 4 ventral teeth; shorter ramus of antennule usually projecting by $\frac{1}{3}$ to $\frac{1}{2}$ its length beyond rostrum. *L. adspersus*.

Rostrum usually with 3 ventral teeth; shorter ramus projecting usually by more than $\frac{1}{2}$ its length beyond rostrum. *L. adspersus* var. *fabricii*.

Distribution in British Isles.—Bell described the species under the name of *P. leachii* from specimens taken in Poole Harbour. Mr. J. Omer Cooper has kindly sent me a collection of prawns from this estuary, which proved to be made up as follows:—

L. serratus	528
L. adspersus	9
L. squilla	5

It is evident that *L. adspersus* is by no means an abundant species. Mr. Kemp has recorded it from two localities in Co. Galway, in one of which it occurs in company with *L. squilla* and *L. serratus* as it does at Poole, and he notes that it has been taken also at Weymouth and in the Thames estuary. I have myself taken two small specimens from between tide-marks at Burnham-on-Crouch, and have had others sent to me from West Mersea, where it is known as the "Mud Prawn," and is taken in some numbers by eel-catchers. It is an estuarine species, preferring a muddy bottom, but Mersea seems to be about its northern limit, as I have not found it in the Stour or the Orwell, and it certainly does not occur in Breydon Water in Norfolk, where conditions would seem to be favourable.

4. Leander longirostris Milne Edwards. (Text-fig. 3.)

P. longirostris M. Edwards, Hist. Nat. des Crustacés, ii. 1837, p. 392.

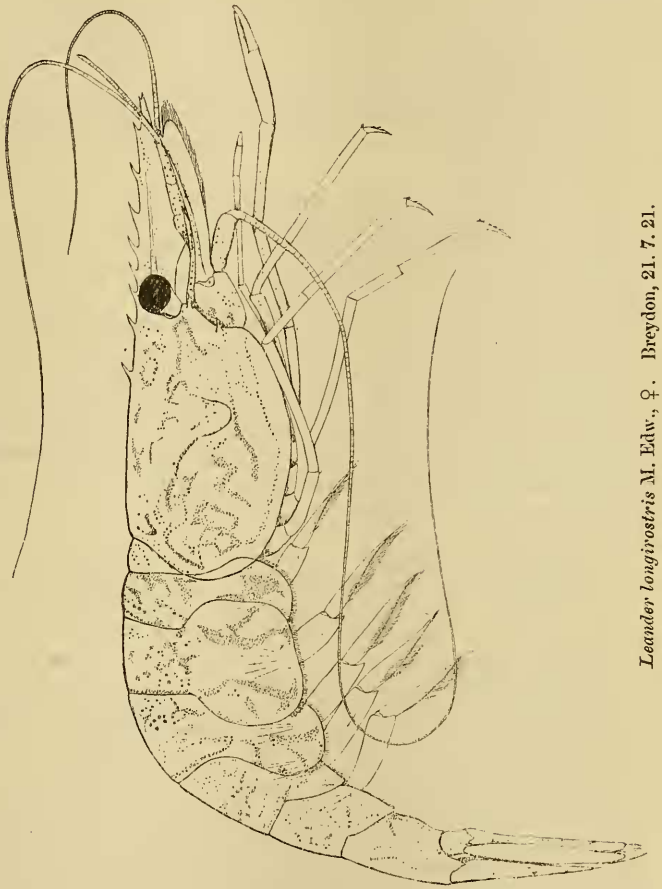
P. edwardsi Heller, 1863.

L. longirostris De Man, 1916, p. 149.

There has been some confusion in the use of the name *L. longirostris*, since not only did Milne Edwards describe two distinct species under the same name, but, by a misplacement of a footnote reference, even the authority of the name was wrongly referred to Say. Milne Edwards himself corrected his second

P. longirostris to *P. styliferus*, which applies to an Indian prawn, but Miss Rathbun is undoubtedly right* in maintaining that the name *L. edwardsi* Heller must give place to *L. longirostris* of M. Edwards.

Colour.—The colour is rather variable, but the majority are,



Text-figure 3.

Leander longirostris M. Edw., ♀. Breydon, 21. 7. 21.

in life, almost colourless, and of an opaque white immediately after death. A close examination shows that the whole body, including the rostrum, is speckled with small red chromatophores. In certain areas these chromatophores are surrounded by a halo of blue pigment, which may sometimes be greatly developed and

* Proc. U.S. Nat. Mus. xxvi. p. 50 (1903).

entirely obscure the red. In such cases, which are rare, the animal appears of a very dark purple-black colour. Occasionally the red pigment alone is present, the blue being suppressed, such specimens appearing of a beautiful rosy colour, the margins of the abdominal segments being more deeply coloured. An unusually large female (75 mm.) of this type was taken in the River Bure in July 1922, and has lived in a fresh-water aquarium for over three months without losing its red colouring. There is a tendency for the chromatophores to become arranged in more or less conspicuous lines and patches (text-fig. 3), but these do not give the appearance of distinct bands as in *L. squilla* and *L. serratus*. The limbs are usually colourless, except for a few scattered red chromatophores, but there is sometimes a faint blue colour on the chelæ.

Length.—Female (bearing eggs) 50 to 77 mm. Male 35 to 77 mm. Usually much smaller than the female.

Rostrum.—The rostrum projects considerably beyond the antennal scales, and is deep and nearly straight, but commonly slightly upcurved. It is usually armed with 8 dorsal and 4 ventral teeth, the dorsal teeth being rather prominent, as in *L. squilla*. The first two teeth are situated behind the eye, the third just in front of the orbital notch. As has been pointed out by De Man, it is particularly characteristic of this species that the space between the first two teeth is one-and-a-half times as great as that between the second and third. The following figures show the variation in the number of rostral teeth in 191 females from Norfolk:—

Dorsal teeth:	10	9	8	7
Individuals:	2	18	108	61
	1·04 %	9·4 %	51·3 %	31·9 %
Ventral teeth:	6	5	4	3
Individuals:	2	6	167	16
	1·04 %	3·14 %	87·4 %	8·4 %

In Norfolk, therefore, the usual formula is $\frac{8+1}{4}$, but De Man found the usual formula for Dutch specimens to be $\frac{7+1}{4}$ and that the dorsal teeth varied from 12 to 6. I have excluded males from my table, but have no reason to believe that they differ in this respect from females. The number of teeth does not increase with age or size, and the smaller size of the male is not of itself likely to reduce the average number of rostral teeth. I have not in all cases noted the number of small apical teeth, but in 46 specimens only 3 had two of these teeth, whereas De Man found this number in 42 per cent. The difference may perhaps be explained on the assumption that the proximal apical tooth, when present in Norfolk specimens, is larger and less separated from the others, and has therefore been counted in

with them. On the other hand, the general frequency of occurrence of the various number of teeth differs so greatly that I am of opinion that a real local difference is shown. De Man's figures are as follows:—

Dorsal teeth:	10	9	8	7	6
Individuals:	8 %	6·6 %	37 %	52 %	1·3 %

Ventral teeth:	6	5	4	3
Individuals:	1·06 %	2·1 %	67 %	29 %

Mandible palp.—Three-jointed, the second joint about half as long as the third in the adult, but only one-third of it in young specimens.

Antennule.—The short flagellum is two-thirds, rarely a little more, of the length of the peduncle, and is fused to the longer flagellum by about one-third of its length. Taking the average of seven measurements, and regarding the total length as 100, the result is as follows:—Fused part 31; free part 69; the free part being therefore about twice the length of the fused part.

Second leg.—The second leg reaches beyond the antennal scale by the whole of the chela and usually about one-third of the carpus. The dactylus is usually nearly one-third of the length of the whole chela, but the proportion is very variable, and it may sometimes be nearly equal to the palm. The chela of this leg does not therefore provide means for distinguishing this species from *L. adspersus*. The chela exceeds the length of the carpus by about one-tenth, and the carpus is usually slightly longer than the merus. Carpus and merus are, however, so nearly equal that very careful measurement is necessary to determine which is the longer. An average of 20 measurements gave the figures:—Carpus 101; merus 100!

Distribution.—*L. longirostris* has been recorded from Liberia (Rathbun), Corsica, and the French coast at Noirmoutier. It has also been found in the River Gironde as far up as Bordeaux, and in the Loire up to Vertou (30 miles). In the British Museum there are specimens from near Seville, about 50 miles up the River Guadalquivir. De Man found it to be common at certain points on the Dutch coast. In the estuary of the Meuse it is abundant in the Hollandsch Diep, and has been taken as far up as Werkendam, which is just above the Biesbosch. It occurs also in the Zuider Zee, the Ij, in the Rhine near Katwijk, and in the Scheldt up to Antwerp. It therefore inhabits estuarine regions, but within the range of sea-water. De Man only records *L. squilla* from the outer Scheldt on the Zeeland coasts, so that it seems to be replaced in Holland by *L. longirostris*.

In Norfolk this prawn is abundant in Oulton Broad, and in Breydon Water at certain times, and it is known to local fishermen as the "Jack Shrimp" or "White Prawn." In Oulton it is used as bait for perch-fishing, but not for food. In Breydon it is said to be more numerous when there is much fresh water passing

down, but it is found in abundance, at all events in the breeding-season, even when the water is entirely salt. On the other hand, the numbers are generally found to increase towards the upper end of the estuary. It is never taken at sea by the shrimpers, though it is said to be caught occasionally just at the mouth of Yarmouth Harbour. Mr. Patterson has sent me specimens taken at St. Olaves on the Waveney, and probably its distribution is continuous from Yarmouth to Oulton Broad via the Waveney. No doubt it also occurs in the Yare, at least as far as Reedham, but I have not been able to search for it there. In the Bure it is common, probably at all states of the tide, as far up as Acle, 14 miles from the sea, and I have even taken it in Heigham Sounds, 22 miles from the sea. It is well known to the eel-catchers, and numbers are taken in the eel-nets at certain times. At South Walsham eel-set they are usually found in the net after there have been high salt tides in the river and the salt water is beginning to run down again. At such times they are also commonly taken in an eel-set near Hickling Broad.

To judge from its distribution in Norfolk, *L. longirostris* is essentially a river prawn capable of existing either in salt or in fresh water, but preferring that part of the river in which the water is generally brackish. Their indifference to salinity is such that they may be repeatedly transferred directly from fresh water to salt and *vice versa* without any apparent ill-effects, and I have at this moment a number which, taken originally in salt water, have been living for months in pure fresh water. One of these, after hatching her young in salt water in June 1921, was transferred to a fresh-water aquarium in which she moulted 10 days later, and is still (November 1922) flourishing. This indifference to salinity can be equalled by very few animals and surpassed by none.

Breeding.

The fact that, in order to catch *L. longirostris* with certainty and in any numbers, it is necessary to use a trawl either in the lower reaches of the rivers or in Breydon Water, has rather restricted my opportunities for observation, and I have not been able to get representative collections throughout the year. It is, however, certain that breeding begins at the end of May or beginning of June, as it does in *L. squilla*, and that two broods are hatched in the season. A number of specimens taken far up the River Bure on May 16, had ripening ovaries, but no eggs had been laid, but on June 15, 1922, out of 98 females taken in Breydon Water, 48 bore eggs in various stages, 42 had hatched but had not moulted, while 8 had hatched and moulted, and were ready to lay another lot of eggs. All, except one with freshly-laid eggs, had the ovary full. As development probably takes at least a month, and the moult following hatching occurs usually 4 or 5 days later, the first eggs must have been laid this year about May 10. No doubt the larger two-year-old prawns spawn about the middle of May, and are followed towards the

end of the month or in June by the younger females. During June and the first half of July every female taken either bears eggs or can be shown to have hatched young; but about the middle of July, though a large proportion bear eggs, many have evidently ceased to breed. For example, out of 103 specimens taken on July 14 there were 33 with eggs, 46 without eggs, and 24 males. In all the females the ovary was empty.

Egg-bearing females migrate down into salt water as the time of hatching approaches, and, so far as my observations go, the larvæ are very rarely hatched in the river itself. While I have had the larvæ hatch in aquaria in salt water on several occasions, they have never done so when the parent has been kept in fresh or slightly brackish water. In such cases the eggs are eventually stripped off. In more than one case a female kept in fresh water past the time at which the young were expected to hatch has been put directly into salt water, with the result that the young have hatched during the following night. Probably hatching takes place always at night under normal conditions, and the young are carried out to sea by the ebb-tide. I have only once caught a single larva in an early stage of development, in spite of much search in Breydon Water at the height of the breeding-season. A few larvæ in the last stage are occasionally found in Breydon, and doubtless metamorphose there, but the great majority must complete their development at sea and migrate up the rivers in the post-larval condition. Young prawns have been taken 12 miles up the river towards the end of August between 19 and 25 mm. long, but it is by no means easy to obtain these young stages, and it is probable that they are to be found in Breydon much earlier. On the other hand, a very careful search for them on August 28, 1922, in the shallows and among Zostera, was entirely unsuccessful, so that it is not improbable that immigration is delayed to a later stage than is the case in *L. squilla*. Mortensen found that the young of *L. adspersus*, though appearing in the shallows about the middle of July, do not reach the innermost parts of certain fjords during the first summer.

Moulting.

The process of moulting takes place usually at night, but I have been fortunate in having been able to witness it on two occasions during the daytime. On each occasion the prawn was found in a peculiar position, the body greatly flexed, the head bent sharply downwards. The cuticle breaks between the thorax and abdomen, leaving the anterior sclerite of the latter attached to the first segment. The thorax then bulges out through the opening, and the animal draws the whole of the thorax and appendages out evenly, without pause. Immediately after freeing the eyes and antennæ, the animal gives a sudden leap forwards, freeing the abdomen instantaneously. The whole process took a

surprisingly short space of time, probably not more than half a minute, but no doubt there were preliminary movements which were not observed. After the moult the movements are most erratic. The prawn may leap about with violent movements of the abdomen or lie on one side in apparent discomfort, moving its appendages continually. Some hours elapse before normal progression is resumed. The very erratic movements immediately after the moult are very likely due in part to the fact that the otocyst is empty, and I was not able to see the process of inserting new grains of sand. The cast skin is often eaten, at least in part, while the newly-moulted prawn frequently falls a victim to its companions.

Breeding females do not, as is commonly the case in Caridea, moult immediately after hatching of the eggs. Both this species and also *L. squilla* and *P. varians* moult 4 or 5 days after hatching, but the moult may be delayed even longer. For example a female about 70 mm. long was taken on July 17, the condition of her pleopods showing that she had recently hatched young; but she did not moult till August 19, or 33 days later.

I am unable to say at what intervals adult prawns normally moult, since this can only be ascertained by keeping single individuals for long periods under as nearly as possible natural conditions. Warrington's observations on this point are, in my opinion, quite unreliable, since several prawns were kept in the same aquarium. The female mentioned above moulted a second time on October 5, an interval of 47 days, no growth having taken place. On the other hand, another adult female kept for over a year in fresh water has only moulted once during the whole period.

5. Palæmonetes varians (Leach).

Colour.—To the naked eye *P. varians* is generally almost colourless and translucent, except for traces of yellow-orange colour at the end of the abdomen and on the joints of the legs. Under a lens the whole body is seen to be speckled with small blackish chromatophores. On the thorax these are generally arranged in lines, and have a faint yellow halo, while a few pure yellow chromatophores are scattered among them. The rostrum is colourless, except for a row of orange-yellow chromatophores below and of black ones along the middle line. The eye-stalks and antennules are richly pigmented. The abdomen is speckled with black and yellow like the thorax, but there is also an orange spot at the junction of segments 4 and 5, and 5 and 6. The uropods and telson have orange and black spots, but the pleopods are colourless. The chelæ of the second legs have an orange patch at the base and at the end of the dactylus, while a similar patch is seen on the merus of the remaining legs. Barrois* has

* Bull. Soc. Zool. France, xi. (1886).

described the colour of this species, and has drawn attention to the orange colour of the chelæ as a striking character.

Length. Female 29–43 mm. Male 18–25 mm.

Mandible.—Palp absent.

Rostrum.—The rostrum is narrow and straight, or even may be somewhat depressed, and it is armed with a variable number of teeth. I have examined a large number of specimens from Norfolk and from other localities, and find that the formula $\frac{5}{2}$ is by far the most usual. A small apical tooth is present in more than half the individuals. Four or six dorsal teeth are not uncommon, but it is exceptional to find more or less than two ventral teeth. Only one tooth is situated on the carapace behind the eye.

The number of rostral teeth has long been known to be variable, and this variation has been studied by Weldon *, Brozek † and others. The latter has made a statistical study of the numbers of teeth in specimens from various localities in fresh and brackish water, and concludes that the fresh-water form from south Europe has on an average a larger number of dorsal teeth than the brackish northern form. His figures are as follows:—

Plymouth (Weldon)	4·3
Lago di Castello (Italy)	4·9
Skutari	6·4
Montenegro	6·3
Monfalcone (Istria)	5·7

As in a later paper he has given the frequency for 134 specimens from Copenhagen to have been 6·22, there seems to be no ground for supposing that the number of teeth has anything to do with geographical situation or salinity.

It is, however, not improbable that a statistical study of the rostral teeth based on a large material would show constant local variations, since many populations of this species must be isolated for long periods and subject to intense selection. The result is hardly likely to justify the great labour necessary, but it may be of interest to summarize such facts as I have collected bearing on this point (Table II.). The figures given in this table express the frequency of occurrence of various numbers of dorsal teeth as percentages of the individuals examined. It should, however, be mentioned that Weldon's figures alone are drawn from a really adequate material (915 specimens). So far as the figures go, they show that six dorsal teeth is far more frequent on the East Coast and in Scotland than it is at Plymouth, though the examples from the Stour are an apparent exception. The range of variation is also less.

Antennule.—The shorter flagellum is about four-fifths, or

* Journ. M. B. A. n. s. i. p. 459 (1890).

† SB. K. Böhm. Ges. Wiss. Jg. 1907, 1909, and 1912.

between 70 and 80 per cent. of the length of the peduncle, and the fused basal part is almost three-quarters of its total length (between 70 and 75 per cent.).

TABLE II.

Dorsal rostral teeth of *P. varians*.

Number of teeth.

Locality.	Author.	1.	2.	3.	4.	5.	6.	7.	8.
Monfalcone, Istria	Brozek.	...	...	...	2	31	57	10	1
Plymouth	Weldon.	2	2	13	41	38	5	1	
Forth Estuary, Scotland ...	Evans.	5	9	2	9	42	28	2	2
River Bure, Norfolk	R. G.	...	...	...	20	53	20	7	
Wells, Norfolk.....	„	...	...	...	15	51	34		
Maldon, Essex	„	...	...	...	45	27	27		
Stour Estuary, Suffolk	„	...	...	...	35	58	6		

Second leg —Reaches, when extended, beyond the antennal scales by the dactylus or part of the dactylus only. The dactylus is about half the length of the palm. The carpus is very long, and greatly exceeds the length of both the chela and the merus.

The Telson.—The form and armature of the telson is very constant throughout the Palæmonidæ, and that of *P. varians* is normally armed in precisely the same way as is that of the British Leanders—namely with two pairs of small spines on the dorsal surface, two pairs of large terminal spines, and a pair of feathered setæ springing from beneath the median triangular prolongation of the telson. There are, in addition, one or two (normally one) small hairs on either side of the projection dorsally.

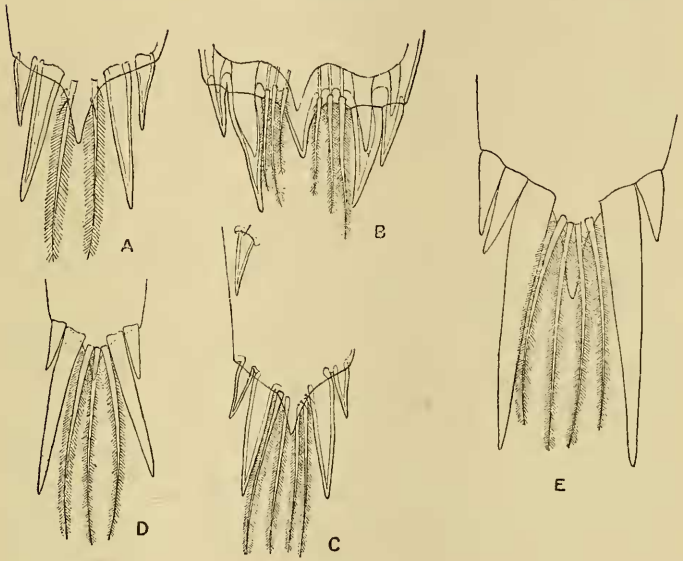
This arrangement of spines and setæ is very variable in *P. varians* from Norfolk. Out of 30 specimens taken in the River Bure only 17 were entirely normal, three more differed only in having an additional pair of dorsal setæ, and one in having an additional minute ventral seta. The remaining nine were strikingly abnormal in respect either of the number of terminal spines or of ventral feathered setæ, as follows:—

One had only a single feathered seta in the middle line.
Four had three of these setæ.
One had four, one had five, and one had six feathered setæ.
One had three pairs of terminal spines.

The specimen with six setæ (text-fig. 4 B) is evidently a case of the retention of the whole of the original seven pairs of larval setæ.

These deviations from the normal are of some interest, since systematic importance has been attached to the numbers of these feathered setæ, and the presence of more than two of them has been given as one of the principal characters of the genus *Allocaris* Sollaud. It is evident that it possesses neither generic nor specific importance. Pesta* has already shown that Sollaud's genus is untenable on this and other grounds. and states that he has found four setæ in the telson of *P. varians* from Albufera.

Text-figure 4.



Telson.

A. *Palæmonetes varians* with supernumerary pair of dorsal setæ.
B. „ „ „ four supernumerary ventral setæ.
C. *P. varians* from Algeria.
D. *L. squilla* with three ventral setæ.
E. *L. serratus* with additional spine and four ventral setæ.

I possess specimens from Algeria which likewise all have four setæ.

The frequent presence of supernumerary setæ in *P. varians* is no doubt a primitive character, or perhaps more precisely a retention of a larval character comparable to the non-development of a mandible palp.

In the British species of *Leander* the telson varies very little, but supernumerary feathered setæ are occasionally met with.

* Ann. K.K. Naturh. Hofmus. Wien, xxvii. (1913).

For instance, among 30 specimens of *L. squilla* from Wells one possessed three of these setæ. Among ten *L. serratus* from Poole one was found not only with four setæ, but with an additional terminal spine (text-fig. 4 E).

Distribution.—As is well known, *P. varians* inhabits fresh water in the Mediterranean region and brackish or salt water on the North Sea and Atlantic coasts, but it is not exclusively a fresh-water species even in the Mediterranean region, since it is recorded by Gourret* in salt water in the Étang de Thau and Étang de Berre on the south coast of France, in company with strictly marine species such as *Leander xiphias*.

The distribution has been fully described by Barrois †, but may be briefly repeated here with some additions.

In fresh water it is recorded from several of the Italian lakes, Venice, Dalmatia, Montenegro, Scutari, Corfu, Turkey, Egypt, and Mesopotamia. According to Pesta, *Allocaris sinensis* is only a variety of this species, its distribution being thereby extended to China (Pekin). It has been found in a hot spring at San Giuliano, near Pisa, at a temperature of 28·75° C. In Tunisia it is said to be very common in fresh waters in the south (Gabes, Tozeur, &c.), and has even been found in water at a temperature of 25° to 27° C. I have taken it myself in a stream near Biskra in the Algerian Sahara.

In salt or brackish water it has been found in the Étangs de Berre and Thau (S. France), the Black Sea, Seine Estuary, Boulogne and Pas-de-Calais, coasts of Holland and Friesland, Portugal, Denmark, North Germany and Sweden.

In Britain it is probably widely distributed. It is recorded from several localities on the coast of Devon, Dorset, and Cornwall, and seems to occur all round Ireland. It has also been taken in the Isle of Wight, on the Northumberland and Durham coasts, and by the estuaries of the Forth and Clyde in Scotland.

In Norfolk the great stretch of salt marsh between Thornham and Salthouse is eminently suited to the requirements of *P. varians*. These marshes are seamed with muddy creeks which are empty at low tide, but the marsh between lies for the most part above the level of spring tides. Dotted over this marsh are innumerable small pools full of brackish water, and in almost every one of them these prawns are to be found. Late in autumn the young of the year swarm in these pools, having reached a size of about 20 mm., but in June, when maturity is reached, the numbers have decreased most strikingly, showing a great mortality during winter and spring. When breeding begins, the water in some pools may become almost thick with larvæ, very few of which probably survive even to the post-larval condition, since the available food must be rapidly used up. In two pools at Blakeney examined in June large numbers of larvæ were found together with quantities of the Copepod, *Eurytemora lacinulata*.

* Ann. Mus. Hist. Nat. Marseille, v. (1897).
† Bull. Soc. Zool. France, xi. (1886).

When the same pools were visited again in August all the *Eurytemora* had disappeared, and the numbers of young *Palæmonetes* were far less than of the larvæ previously present.

The marshes are occasionally flooded by exceptionally high tides, which may sometimes occur in early summer. In such cases the young must be washed out to sea and spread about along the coast. If it were not for such floods, every pool would become an isolated unit in which a struggle for existence of extraordinary intensity would operate, and the circumstances would be most favourable for the establishment of local races. How far the population of the various pools are in fact isolated it is difficult to ascertain, but there are pools which are probably not flooded by any but very exceptional tides such as occur at intervals of several years. Probably, however, isolation in this sense rarely, if ever, persists for very long, and the sea carries the larvæ up and down the coast, intermingling the various populations.

Breeding-period, &c.

The breeding-period begins, in Norfolk, about the middle or end of May and ceases about the end of July. Larvæ were first met with this year near Yarmouth on June 16, all being in the first stage and hatched since about four days, as most of them moulted within the next two or three days. On June 17 zoæas, nearly all in early stages, were found in great abundance at Wells, so that about the middle of June may be regarded as the main hatching-season. The records of the Marine Laboratory at Plymouth show breeding to begin there in April and to continue till July. The eggs are carried 5 or 6 weeks before hatching, if I may judge from a single female kept in an aquarium, but probably both the rate of development of eggs and larvæ would be rather more rapid in natural conditions. After July I have not found egg-bearing females, and larvæ in early stages are not met with.

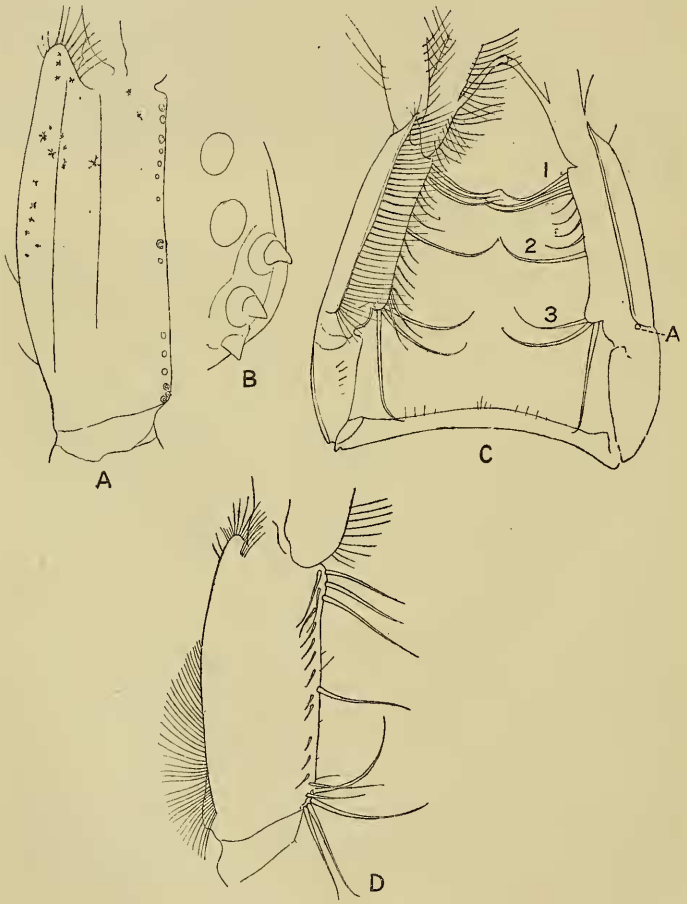
I have not found any direct evidence of females producing a second brood, as is usually the case with *L. squilla* and *L. longirostris*. Examination of large numbers of young taken in September bears out the conclusion that second broods are the exception. That second broods are, however, produced occasionally there can be no doubt, for in some cases the young are found to fall distinctly into two age-groups. For instance, in a pool at Cley on September 6 it was possible to draw a clear distinction between young of 17–22 mm. representing the first brood, and others of 11 mm. or less, some of which were still in the second post-larval stage and must have been hatched about the end of July.

Probably the production of a second brood depends a good deal on local conditions, and is likely not to take place in such small pools, which must be extremely overcrowded, whereas it may be the rule in other and more favourable conditions.

Modification of the Pleopods for egg-bearing in Leander *and* Palæmonetes.

The pleopoda of the British prawns (I have not been able to examine *L. adspersus* in this respect) are subject to special modification for the purpose of egg-bearing which, so far as I can find, has not been previously referred to.

Text-figure 5.



Second pleopod of female.

A. *L. squilla* after moult following hatching of eggs.
B. The same, proximal inner corner more enlarged.
C *L. squilla.* Moulted skin after hatching of eggs.
D. *L. longirostris.* Before laying of eggs.

The condition of the pleopods in the female before and after the breeding-period is shown in text-fig. 5. The shaft or basipodite is broad and flattened on its outer edge into a thin flange, which is either bare or carries a few irregularly-placed setæ. Along the inner face of this joint is a series of circular markings which appear to be spots where the cuticle is thin or pierced by a pore. In the centre of some of them is a short conical projection or spine, and the arrangement of these "spinous discs" is definite and apparently almost constant.

At the moult immediately preceding the laying of eggs a great change takes place. A dense row of feathered setæ appears along the outer side of the basipodite and on its posterior surface, being slightly overhung by the thin outer flange. At the same time, on the inner edge of the joint the place of the "spinous discs" is taken by a series of long, smooth setæ, while a variable number of shorter setæ spring apparently from the remaining circular spots. These long setæ are not the same in number in each pair of legs, but have a remarkably regular arrangement. They may be described as forming three groups as numbered in the figure, while an additional seta may be present on the anterior face in a position corresponding to the letter "A" in the figure, and may be regarded as accessory to Group 3. The following arrangement of these setæ was found in a specimen of *L. squilla*, and may be taken as typical for all the species:—

		Pleopod.				
		I.	II.	III.	IV.	V.
Number of setæ: Group 1 ...		4	3	3	—	—
„ 2 ...		—	1	1	—	—
„ 3 ...		3	3	3	3	—
„ 3 A ...		1	1	1	1	—

It is to these setæ on the inner face that the eggs are attached, and the outer feathered setæ are no doubt developed partly as a protection to the eggs, and partly to assist in promoting a current of water through them.

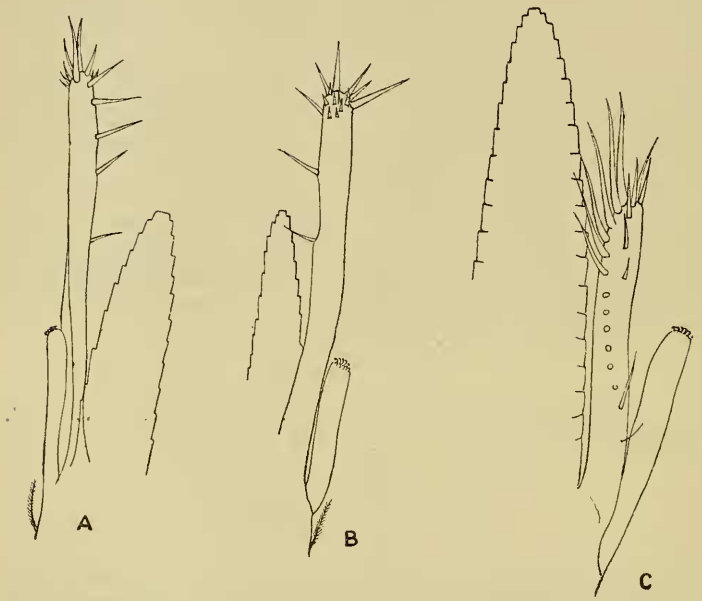
The presence of these ovigerous setæ may be taken as a certain indication that eggs are about to be laid, or that young have been hatched; while their loss marks the end of the breeding-season.

Palæmonetes varians var. *mesogenitor* Sollaud.

The peculiarities in the reproductive habit of the brackish and fresh-water forms of *P. varians* are well known, and "physiological" varieties have been distinguished, namely var. *microgenitor* Boas, var. *mesogenitor* Sollaud, and var. *macrogenitor* Boas, according to the size of the eggs laid and the stage of development at which the young are hatched. These varieties are, however, said to be structurally indistinguishable.

The variety *mesogenitor* Sollaud* occurs in Tunisia, and I have a few specimens, taken in the stream flowing from the Sources D'Oumach, near Biskra, in Algeria, which would probably belong to this variety. They are all small, not exceeding 24 mm., but include four adult males, while the females appear also to be fully grown. While the females differ to some extent from Norfolk specimens in the relative length of the joints of the second leg and the proportions of the short flagellum of the

Text-figure 6.



Palæmonetes varians.

A and B. Posterior and anterior views of appendix masculina of two specimens from Algeria.

C. Appendix masculina of specimen from Essex. 34 mm.

antennule, the material is not sufficient to justify any definite conclusion as regards varietal or specific differences. It is otherwise with the males. In all these four males there are two characters which very distinctly separate them from the brackish-water representatives of the species. These are:—

(1) The *appendix masculina* of the second pleopod is slender, and extends by nearly half its length beyond the inner branch of the pleopod. There is a group of strong spines at its apex, but the sides and anterior face are bare or armed with only one or two

* Sollaud, C. R. Acad. Sci. Paris, t. 155, p. 1268 (1912).

spines (text-fig. 6 A, B) In Norfolk specimens (text-fig. 6C) the appendix is always very much shorter than the inner branch of the pleopod, and is provided with a row of spines along the inner and anterior side. This difference is very striking, and easily seen without dissection.

(2) The short flagellum of the antennule is almost or quite as long as the peduncle, and the free part is nearly half as long as the fused part.

TABLE III.

Comparison of measurements of Norfolk and Algerian specimens of *P. varians*.

	Second Leg.					Antennule.			
	Dactylus.	Chela.	Palm.	Carpus.	Merus.	Peduncle.	Short flagellum.	"Fused" part.	Free part.
Norfolk, ♂	100	250	150	325	264	100	62	45	17
,, ♀	,,	269	169	331	254	,,	70	49	21
Algeria, ♂	,,	267	167	329	236	,,	100	64	36
,, ♂	,,	...	...	...	...	,,	96	67	29
,, ♀	,,	295	195	368	280	,,	68	59	9

In all the specimens, male or female, there are either three or four feathered setæ on the telson.

I have not been able to examine any representatives of the South European fresh-water form, and, so far as I know, no attention has previously been paid to these two characters of the male, so that it is possible they may be found to be distinctive not of var. *mesogenitor* alone, but also of var. *macrogenitor*. I consider them of such importance as to justify the separation of the Algerian form as a distinct species, which, if it should prove to be identical with the Tunisian form and not to share its characters with var. *macrogenitor*, should take the name *P. mesogenitor* Sollaud *.

* Since the above was written M. E. Chevreux has been good enough to send me specimens of *P. varians* from Lake Fetzara in Algeria, but unfortunately they proved all to be females. I have also, through the kindness of Dr. W. T. Calman, been able to examine specimens of the var. *macrogenitor* from several localities in south Europe and find that the *appendix masculina* does not differ from that of the brackish-water variety.